

Notice of Allowability

Application No.

10/605,306

Examiner

Stephen W. Smoot

Applicant(s)

KUAN ET AL.

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to applicant's amendment filed on 19 January 2005.

2. ☒ The allowed claim(s) is/are 1-3, 5, 6, 8-13 and 20.

3. ☒ The drawings filed on 22 September 2003 are accepted by the Examiner.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☒ All b) ☐ Some* c) ☐ None of the:

1. ☒ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

(a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached

1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.

(b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)

2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date _____

4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material

5. ☐ Notice of Informal Patent Application (PTO-152)

6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____

7. ☐ Examiner's Amendment/Comment

8. ☒ Examiner's Statement of Reasons for Allowance

9. ☐ Other _____

Stephen W. Smoot
Patent Examiner
Art Unit 2813

Stephen W. Smoot

DETAILED ACTION

This Office action is in response to applicant's amendment filed on 19 January 2005.

Allowable Subject Matter

1. Claims 1-3, 5-6, 8-13, 20 are allowed.
2. The following is an examiner's statement of reasons for allowance:
 - Claims 1-3, 5-6, 8 are allowed because the prior art of record does not teach or suggest, in combination with the other claim limitations, a method of manufacturing a semiconductor device that includes forming first openings by removing portions of a first dielectric layer and also by removing portions of cap layers and sidewall spacers corresponding to a plurality of conductive structures, combined with the steps of lining the first openings with a liner layer and then forming a bottom plug in the first openings, and further combined with forming a top plug in second openings that expose portions of corresponding bottom plugs, wherein the second openings have a smaller dimension than the first openings;

- Claims 9-13 are allowed because the prior art of record does not teach or suggest, in combination with the other claim limitations, a method of manufacturing a semiconductor device that includes forming openings by removing portions of a dielectric layer and also by removing portions of cap layers and sidewall spacers corresponding to a plurality of conductive structures, wherein shoulder sections that correspond to conductive layers underneath the cap layers are exposed and are removed to form shoulder recesses, combined with the steps of lining the openings with a liner layer and then forming conductive plugs inside the openings; and
- Claim 20 is allowed because the prior art of record does not teach or suggest, in combination with the other claim limitations, a method of manufacturing a conductive plug over a substrate that includes forming first openings between conductive structures, wherein recesses are formed on sidewalls of the first openings proximate to shoulders of the conductive structures, combined with the steps of lining the first openings with a liner layer and then forming a bottom plug in the first openings, further combined with forming a top plug in second openings that expose portions of corresponding bottom plugs, and forming wire lines that are electrically connected to and over the top plugs.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Huang and Graettinger et al. teach contact plug methods that feature partially etched cap layers, partially etched spacers, and liner layers.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-272-1698. The examiner can normally be reached on M-F (8:00 am to 4:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).